



Final Report for Pollution Prevention Grant Program

Indiana Department of Environmental Management

Office of Pollution Prevention and Technical Assistance

POLLUTION PREVENTION GRANT PROGRAM

100 N. Senate Avenue, Mail Code 64-00

Indianapolis, IN 46204-2251

Internet: www.in.gov/idem/prevention/p2grants/

INSTRUCTIONS: The Report Form is designed to satisfy standard grant reporting requirements. Grantee should consult Exhibit A of their grant agreement for additional reporting requirements. Attach additional sheets if necessary and label attachments according to the number of the final report question.

SECTION 1

GRANT INFORMATION

Date:	10.22.2008	EDS #:	A305-8-142
Grantee:	Harrison Steel Casting Company		
Person Completing Report:	Brooks Snyder, Environmental and Safety Director		

SECTION 2

REPORT QUESTIONS

1) Please provide a summary of grant funded activities.

Our casting process relies on urethane binders, Part 1 and Part 2, to make our molds and cores. Part 1 and Part 2 are mixed together in a 60/40 ratio into sand on a 1% by volume concentration; which can then be formed into the shapes (molds and cores) we need. Once the molds have hot steel poured into them, they release VOC's into the air from both the mold and core(s).

With the guidance of HA International, Harrison Steel determined that we could reduce the amount of VOC's emitted from our pouring, cooling and shake out processes by switching to a biodiesel binder in the cores of our molds. We ran three tests with three different Part 2 binders to verify that we could reduce the VOC's emitted, yet maintain the quality and integrity of our parts. In all three trials, we used the same Part 1 (Techniset F6073 biodiesel). The only variable was the Part 2 binder. We used Techniset 6435 first (low VOC non-biodiesel), and then Techniset 6636 biodiesel and finally Techniset 6636T (TEOS) in the third test, all of our in-house testing was successful. The new combination of binders were able to meet our requirements for tensile strength, also there were no quality issues reported due to the change in binders.

In order to accurately quantify the reduction in VOC's emitted due to the change binders; we needed to emulate the tests in a laboratory setting. In our foundry there are many sources of VOC's that would contaminate any sampling done. We sent our binders to Technikon's Casting Emissions Reduction Program's (CERP) laboratory (www.technikonllc.com) in California to run the tests. With some historical data from previous emissions testing on biodiesel binder along with the results from our three trials, we calculated a 5% increase during trial 1 and a 9.4% reduction in trials 2 and 3. Moving forward, we are going to extend trials 2 & 3 (6636 biodiesel and 6636T). We are not going to pursue the 6435 combination at this time due to the higher emissions. The ultimate goal is to utilize the lowest emitting recipe in both the molds and cores.

a) Were the goals outlined in the grant application attained?

Yes, we can reduce the amount of VOC's that are emitted from our pouring, cooling and shake-out processes by almost 10%. At current production levels, we can reduce our emissions by 3,016 pounds over the course of a year of production utilizing the biodiesel combinations from trials two and three.

2) Has the amount of pollutants decreased and/or has the amount of conserved natural resources increased?

We determined that we can decrease the amount of VOC's emitted by 3,016 lbs by switching to a biodiesel binder.

a) Provide increase or decrease in appropriate metrics and provide the method for calculating this.

We utilized an outside testing lab, which was able to recreate our pouring, cooling and shake-out operations, and under very controlled parameters captured and analyzed the amount of VOC's emitted from the process. If we apply the new emissions factors to the 2007 volumes of production, then we can forecast 3,016 pounds of VOC's that will not be emitted because of the change in binder.

3) Provide an annual projection of the amount of pollutants decreased or natural resources conserved.

We will decrease the amount of VOC's emitted from Harrison Steel's pouring, cooling and shake out process by 3,016 lbs by integrating biodiesel technology.

a) Provide the method for calculating this number(s)?

At CERP, they were able to use EPA Method 25A to capture and calculate the amount of VOC's emitted. This is the same method that we use in our Title V air permit testing for VOC's. Once we have the new emission factors for pouring, cooling and shake-out on a lb of VOC's emitted per ton of steel poured, then we can multiply 2007 production volumes by emissions factors and determine the amount of emissions that will be released. Then we compared the difference.

4) If someone wanted to emulate your project, what information would be most helpful? Please outline successes and failures so others can learn from your project.

One of the keys to our success was proper set-up. Specifically, changing out hoses, purging pumps of the old binder and then having the infrastructures to track the cores as they went through the pouring, cooling and shake-out process. We did not compromise any of our product quality during the trials.

Another key was to constantly sample the sand and evaluate the bond strength of the sand as it is being mixed. We felt that over sampling was the best

approach, thus providing a higher confidence that we would not see quality issues down the road.

One pitfall to avoid would be over utilizing the bio-diesel binder due to the differences in reclamation properties than that of the urethane binders. Our supplier HA International was able to provide initial guidance during the trial and will continue to assist in predicting any problems that might arise during the cross over.

5) Provide a program sustainability plan that indicates how you will continue the program without grant funding.

Since the P2 program conclusion, we have already run another trial with as low as 0.97% by volume binder with minimal changes in the quality of our cores. Our next step will be to experiment with TEOS in the molds. This is where we expect to see the greatest effect in the VOC emissions because 80% of the VOCs are emitted from the molds.

6) Attach a completed Grant Expenditure Report that details all expenditures made during the grant term.

Attached



TECHNICAL SERVICE TRIAL REPORT

To: Mike Tremaine

Customer: Harrison Steel

From: Ron Runyon, Jeremy Eastman

Location: Attica, IN

Salesman: Mike Tremaine

Call Date: June 3-4, 2008

HAI Personnel: Mike Tremaine, Jeff Lehman, Will Davis, Jeremy Eastman, Ron Runyon

Customer Personnel: George Veedersburg, Jerry Riley, Jim Bauman

OBJECTIVE: Run a two shift trial using Techniset® 6073 UNB Pt I (Lot # LK8EA0181Z) in replacement of Techniset® F6000 UNB Part I to reduce smoke and odor during pouring, cooling and shakeout.

DETAILS: We set up to run on the Dependable mixer just before the start of the second shift. The tote tank was plumbed directly into the lines and the mixer was calibrated after the air was out of the lines. The mix was set at 1% based on the 430 lb. of sand/min. using a 60:40 mix of Part I to Part II. The activator was run at 4% based on Part I. This was not changed from where it was set running F6000.

The first cores were made shortly after 2 P.M. Sand temperatures ranged from 92°F – 97°F. The work time was about 4 min. and the cup strip time was 7.5 – 8 minutes. The first cores made were good and stripped well. The system ran very well the entire second shift with only one scrapped core. This happened about an hour into the shift. The cause for the scrapped core was a lack of activator at one end of the large core. Jerry found that a valve in the activator line was just barely open so he opened it up and there were no more problems. Late in the second shift we did see a little problem with one of the iron oxide feeders so at least one core was made with little or no oxide.

Three tensile tests were run on the second shift, shown below in Table 1. As can be seen in the 60 min, bake, and rebake the tensiles improved every time the samples were heated or baked. By baking the cores/molds become fully cured without the influence of humidity degradation that can occur.

HAI 2 nd Shift Tensile	5:30 P.M.	7:45 P.M.	9:15 P.M.
30 min	136	111	151
Bake	215	259	291
Re-bake	264	275	285
24 hr	146	139	158

Table 1. June 3, 2008 2nd shift tensile testing results.

Third shift operations ran without incident. Sand temperatures were consistent with what was measured on 2nd shift. Strip time was also keeping with 2nd shift operations. During the production of cores, some were allowed to cure on tables. An overhead water pipe was dripping condensation on these cores from over head. If the cores are molded without enough time for that water to evaporate, the water could cause a blow. In addition, the water will degrade the strength of the core in the adjacent area. Other than that the only mixed sand issues were with the powder feeder. The powder feeder was not functioning consistently at times. We have been informed by plant personnel that employees sometimes fill the hopper to full and it becomes "bridged" so that no material will flow through. As a result, high and/or low concentrations of iron oxide in the sand were visible as darker or lighter colored "swirl" patterns in the core sand. As the concentration of iron oxide changes so does the distribution of the total aggregate mix. As this distribution changes, so does the surface area of the sand per unit volume. Consequently, the binder thickness is affected. If the concentration drops off, for example, then the binder coating is thicker creating stronger cores and molds. If the concentration increases, then the cores or molds are weaker. Despite the issues with the powder feeder cores were strong with good surface hardness.

Two tensile tests were performed on 3rd shift. The results are shown in Table 2. All of the results as shown in Table 2 were from samples which cured naturally, or without the aid of an oven. The results as shown for 11:45 P.M. samples were weaker than other samples tested during the trial. These samples were made from sand that was obtained directly after a brief on/off run in which a core was filled. It was assumed that the core sand mixture was homogeneous. Given the mixer design, it is possible that the "turbo" head was not filled during this time as well as if it were running continuously so that the two various sand blends (Part I/ Part III with sand and Part II with sand) were not mixed as well as they could have been. At no time during the production of cores on 3rd shift were any scraped due to breakage.

HAI 3 rd Shift Tensile	11:45 P.M.	1:40 A.M.
30 min	46	126
1 hr	84	157
2 hr	75	184
24 hr	93	150

Table 2. June 3/June 4 3rd shift tensile testing results.

Tensile testing performed by plant personnel were found to be consistent with HAI testing, with the exception of 3rd shift 11:45 A.M. which could be considered an outlier given the sample origin. The results of those samples are shown below in Table 3.



TECHNICAL SERVICE TRIAL REPORT

To: Mike Tremaine

Customer: Harrison Steel

From: Ron Runyon

Location: Attica, IN

Salesman: Mike Tremaine

Call Date: June 16-17, 2008

HAI Personnel: Mike Tremaine, Jeff Lehman, Ron Runyon

Customer Personnel: George Veedersburg, Jerry Riley, Jim Bauman

OBJECTIVE: Run a two shift trial using a tote of Techniset 6073 Pt.1 replacing Techniset F6000 and a tote tank of Techniset 6636 to replace 6435 to reduce odors and VOC on the Core Room line.

DETAILS: We set up to run on the Dependable mixer just before the start of the second shift. The tote tank was plumbed directly into the lines and the mixer was calibrated after the air was out of the lines. The mix was set at 1 % based on the 430 lb. of sand/min. using a 60:40 mix of Part I to Part II. The activator was run at 4 % based on Part I. There were problems initially getting the air out of the Part II line and then the Part III pump stopped and had to be replaced.

The first cores were made around 3:30. Sand temperatures ranged from 96-98 degrees F. The work time was about 4-4.5 min. and the cup strip time was 8.0 min. The first cores made were good and stripped well. The system ran very well the entire second shift with no scrapped core. The cores were very smoothed and stripped well. The odor was definitely much lower.

Four tensile tests were run on the second shift, two on third and one on first. The results were as follows: Number 8 and number 9 reflect the normal results obtained from the F6000/6435 system on June the 16th and the 18th.

HARRISON STEEL TECHNISET 6073 TRIAL

Tensile	5:50 P.M	6:30 P.M.	8:28 P.M.	9:15 P.M.	#5	#6	#7	#8	#9
30 min.						80	90	117	
60 min.	93	126.7	118	113.3	117	99		57	81
2 hr.					149	137			
24 hr.	126	140	181	145	160	149	182	107	125
45 bake	204.7	231.7	252.7	230			200	158	166
Re-bake	198	248.7	246.7	231.3			260	162	175

RESULTS: Castings were poured on the 20th. Mike Tremaine was in and is following up on these. Based on tensile results it is probable that this system can be run at 0.95 % and possibly as low as 0.9 %. This would reduce HAPS, VOC's and smoke even more and would help reduce the cost of running the system. An extended trial would have to be run to determine if the tensile strengths remained consistently higher than the existing system to determine if the resin level could be reduced as these results indicate.

Harrison Steel Tensile Testing 6/4/08			
Tensile	5:40 A.M.	Tensile	4:00 P.M.
1 hr	135	30 min	86
Bake	233	1hr	101
Re-bake	243	14 hr	145
25 1/4 hr	146	20 hr	150

Table 3. Harrison Steel personnel tensile testing from June 4.

RESULTS: Smoke during pouring operations was no better or worse than with the Techniset® F6000 UNB Part I.

PRODUCTION SAMPLES:

1. 4 ea: 12622016; Thursday 6/5
2. 4 ea: 213-3262; 2 – Thursday 6/5, 2 – Friday 6/6
3. 12 ea: 243-2462; Thursday 6/5
4. 6 ea: 185-7014; Thursday 6/5
5. 9 ea: 212-3494; Friday 6/6
6. 4 ea: 120-6765; Thursday 6/5
7. 4 ea: EL-9507; 3 – Thursday 6/5, 1 – Friday 6/6
8. 3 ea: EK1291; 2 – Thursday 6/5, 1 – Friday 6/6
9. 3 ea: 120-6764; Thursday 6/5
10. 3 ea: 138-9312; Friday 6/6
11. 4ea: 266-21119; Thursday 6/5
12. 3ea: 190-6091; Thursday 6/5
13. 2ea: 179-0744; Friday 6/6
14. 9 ea: 256-7834; Thursday 6/5
15. 9 ea: 7T2297; Friday 6/6
16. 8 ea: 8X8102; Friday 6/6
17. 7 ea: ABC-3T7493; Friday 6/6
18. 6 ea: BC-179-0740; Friday 6/6
19. 2 ea: 131-6748; Friday 6/6



TECHNICAL SERVICE TRIAL REPORT

To: Mike Tremaine

Customer: Harrison Steel

From: Ron Runyon

Location: Attica, IN

Salesman: Mike Tremaine

Call Date: Oct. 6-10, 2008

HAI Personnel: Mike Tremaine, Jay Ketzmier, Ron Runyon

Customer Personnel: George Vredenburg, Ed Blankenship, Jerry Riley

OBJECTIVE: Run a week trial 1. Using Techniset F6073/6636/17727 for two days running at 1 % resin using a 60:40 ratio: 2. Run this system reducing the resin level to 0.95 % for two days: 3. Then on the second shift on Fri. convert to 6636T Part II for a one shift run.

DETAILS: We set up to run on the Dependable mixer just before the start of the second shift on Monday. The tote tanks were plumbed directly into the lines and the mixer was calibrated after the air was out of the lines. The mixer was set up at 1 % resin and 60:40 ratio as planned and 4 % activator based on Part I. The first cores were made around 1:30. Sand temperatures ranged from 88-90 degrees F. Strip times were about 11 min. The first cores made were good and stripped well. The system ran very well on Monday and Tuesday at the 1 % level. The sand temperatures started to drop down into the 84-86 degree F range on Tuesday. We ran 15 tensile tests on the first two days. Our normal strip time on these tensile tests was under 21 min.

On Wednesday afternoon George re-calibrated to 0.95 % resin using the 60:40 with no change in either Part running at 4 % activator. This had to be increased to 4.5 % shortly after start because the cores were setting up too slow. We ran this way on Wednesday and Thursday on second and third shift and ran well. We ran 18 sand tests on this mix.

On Friday afternoon we started up using a 1 % mix of F6073/6636T {TEOS} system and 4 % 17727 based on F6073 {60:40 ratio of Part I to Part II}. We had to increase this to 4.5 % 17727 to speed up the cure. We ran very well. Five sets of tensile were run off this mix. It ran for one shift.

All of the cores were marked as sample cores and will be followed through the system to check for smoke and odor. The F6073/6636 system had less odor at mixing than the normal system. The

F6073/6636T system had a sweeter smelling odor than the F6073/6636 bio-diesel system.

RESULTS: As indicated, the cores will be followed through the system and the results will be evaluated based on casting finish and smoke and odor at pouring. The sand test results are attached below.

HARRISON STEEL TECHNISET F6063/6636 AND 6636T TRIAL OCT. 6-10, 2008

Sand Temperature range 84-89 degree F

DATE	TEST NUMBER	TIME	1 HR.	BAKE	TENSILE REBAKE	{1.0 %} 2 HR.	4 HR.	24 HR.
10 6 08	#1	2:15 P.M.	77 PSI	217 PSI	213 PSI			157 PSI
	#2	4:40 P.M.	89 PSI	245 PSI	225 PSI			133 PSI
	#3	5:55 P.M.	88 PSI	241 PSI	240 PSI			133 PSI
	#4	7:20 P.M.	99 PSI			107 PSI	138 PSI	147 PSI
	#5	8:00 P.M.	91 PSI	270 PSI	232 PSI			140 PSI
	#6	11:50 P.M.	73 PSI	253 PSI	246 PSI			112 PSI
10 07 08	#7	1:40 A.M.	118 PSI	256 PSI	276 PSI			142 PSI
	#8	3:10 A.M.	90 PSI	262 PSI	237 PSI			151 PSI
	#9	2:25 P.M.	85 PSI	268 PSI	243 PSI			156 PSI
	#10	3:22 P.M.	122 PSI	267 PSI	267 PSI			161 PSI
	#11	4:55 P.M.	91 PSI	236 PSI	255 PSI			147 PSI
	#12	6:40 P.M.	88 PSI	242 PSI	209 PSI			163 PSI
	#13	10:55 P.M.	103 PSI	227 PSI	217 PSI			147 PSI
	#14	11:40 P.M.	98 PSI	240 PSI	230 PSI			120 PSI
10 08 08	#15	12:30 P.M.	101 PSI	208 PSI	226 PSI			138 PSI
	0.95 % resin and 4.0 % activator							
	#16	1:53 P.M.	61 PSI	210 PSI	226 PSI			131 PSI
	#17	3:10 P.M.	51 PSI	163 PSI	167 PSI			118 PSI
	0.95 % resin and 4.5 % activator							
	#18	4:03 P.M.	95 PSI	257 PSI	243 PSI			162 PSI
	#19	5:20 P.M.	103 PSI	261 PSI	258 PSI			189 PSI
	#20	7:45 P.M.	92 PSI	242 PSI	216 PSI			162 PSI
	#21	11:12 P.M.	79 PSI	214 PSI	218 PSI			123 PSI
	#22	12:09 A.M.	78 PSI	203 PSI	189 PSI			140 PSI
10 09 08	#23	1:50 A.M.	83 PSI	192 PSI	198 PSI			154 PSI
	#24	3:00 A.M.	94 PSI	212 PSI	183 PSI			124 PSI

#25	2:00 P.M.	104 PSI	246 PSI	241 PSI	153 PSI
#26	3:30 P.M.	113 PSI	242 PSI	251 PSI	169 PSI
#27	5:00 P.M.	108 PSI	234 PSI	245 PSI	161 PSI
#28	6:48 P.M.	92 PSI	251 PSI	240 PSI	161 PSI
#29	7:54 P.M.	106 PSI	255 PSI	229 PSI	
#30	11:17 P.M.	74 PSI	215 PSI	207 PSI	129 PSI
10 10 08 #31	12:01 P.M.	89 PSI	196 PSI	202 PSI	123 PSI
#32	1:08 P.M.				117 PSI
#33	2:00 P.M.	86 PSI	209 PSI	202 PSI	122 PSI

TEOS system 6636T with a total of 1.0 % resin. {F6073/6636T/17727}

4.0 % ACT.

#34	1:55 P.M.	86 PSI		135 PSI	141 PSI
#35	2:20 P.M.	77 PSI	199 PSI	208 PSI	

4.5 % ACT.

#36	3:38 P.M.	97 PSI	245 PSI	257 PSI
#37	4:28 P.M.	91 PSI	246 PSI	242 PSI

George's test

3:53 P.M.	111 PSI	228 PSI	235 PSI
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HARRISON STEEL TECHNISET F6073/6636 AND 6636T TRIAL MEAN TENSILE CHART

OCT. 6-10, 2008

MIX	1 HR. TENSILE	BAKE TENSILE	REBAKE TENSILE	24 HR. TENSILE
1.0 %/6636	94.2 PSI	244.9 PSI	236.9 PSI	143.1 PSI
0.95 %/6636	88.7 PSI	223.2 PSI	218.5 PSI	143.4 PSI
1.0 %/6636T	92.4 PSI	229.5 PSI	233.3 PSI	

Pouring, Cooling, Shakeout Emissions from Techniset Cores Poured with Steel

Draft

Technikon # 8002-001 HZ

This report has been reviewed for completeness and accuracy and approved for release by the following:

Director of Analytical
Measurement Technologies

Sue Anne Sheya, PhD

Date

Vice President of Operations

George Crandell

Date

The data contained in this report were developed to assess the relative emissions profile of the product or process being evaluated. You may not obtain the same results in your facility. Data were not collected to assess casting quality, cost, or producibility.

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1.0 TEST SUMMARY

This report contains the results of a quantitative evaluation of the pouring, cooling and shakeout (PCS) airborne emissions from seacoal-free greensand molds containing HA Techniset® cores and poured with steel. Nine molds containing uncoated cores were poured after the equivalent of three initial sand conditioning runs. The greensand molds were made from Amador S 730 Gold, and western and southern bentonites in a ratio of 5:2.

Step cores were made with virgin Wedron 530 silica sand. Three two-part core binder combinations were compared for emissions. The binder combination and concentrations were as follows: 1) 1.10% based on sand (BOS) HA International Techniset® F6073/6435 for 3 molds, 2) 1.0% BOS HA International Techniset® F6073/6636 for 3 molds, and 3) 1.1% BOS HA International Techniset® F6073/6636T for 3 molds.

Molds were poured with steel at $2890 \pm 20^{\circ}\text{F}$. The pouring time of 8-22 seconds was immediately followed by cooling for an elapsed pouring and cooling time of 25 minutes. This was followed by 5 minutes of shakeout, and a post shakeout cooling period of an additional 45 minutes. Emission samples were continuously collected for the total 75 minute testing period.

The emission results were calculated in both pounds of analyte per pound of binder (lb/lb) and pounds of analyte per ton of metal poured (lb/ton). All emissions have been background subtracted to provide more accurate reporting of results for the material undergoing evaluation.

Quantitation of any total hydrocarbons and non-methane hydrocarbons (NMHC) present in emissions was accomplished through real-time on-line analysis using gas analyzers.

1.1. Testing Program

This emissions test was given the alpha designation of Test HZ, and was designed to evaluate airborne emissions from steel pouring, cooling, and shakeout of molds containing Techniset® cores using three different Part II formulations. The details of the approved test plan are included in Appendix A.

The testing program adhered to for this test followed the same protocol as for all emission tests. This program encompasses the foundry and emissions testing processes, both of which are rigorously controlled. Parameters are monitored and recorded prior to and during the emission tests. Process measurements included the weights of the casting and mold sand, loss on ignition (LOI)

values for the mold and core prior to the test, and relevant metallurgical data. Measured source parameters included stack temperature, pressure, volumetric flow rate, and moisture content. All parameters were maintained within prescribed ranges to ensure the reproducibility of the test runs.

Two methods were employed to measure undifferentiated hydrocarbon emissions as Emission Indicators: TGOc as Propane, performed in accordance with EPA Method 25A, and non-methane hydrocarbons as determined from methane results obtained in a manner similar to that prescribed in EPA historic CTM-042.

Method 25A is an instrument based method in which the stack gas is introduced directly to a flame ionization detector (FID) without first separating the components. In Method 25A, sampling is accomplished by extracting a gas stream from the stack effluent and transferring it via heated non-reactive tubing to the FID analyzer under very controlled temperature and pressure conditions. The FID measures the quantity of carbon containing molecules, and is calibrated by a gas standard, which in this case is the three carbon alkane, propane (C_3H_8). The FID will give a response relative to the calibration standard and results are expressed in terms of the gas used for calibration. Because the FID responds to all carbon containing compounds, methane (CH_4) and other exempt compounds are included in the total hydrocarbon results.

Methane was analyzed by a separate FID equipped with an oxidizing catalyst (methane cutter) that removes all non-methane hydrocarbons (NMHC). The calibration gas for this FID was methane (CH_4). The two FIDs were run simultaneously, and collected data every second. Average results were calculated over the entire pouring, cooling and shakeout periods for each run. NMHC results were then determined by directly subtracting the detected methane from the total hydrocarbon value.

Mass emission rates for all analytes were calculated using continuous monitoring or laboratory analytical results, measured source data and appropriate process data.

1.1.1. Emission Sampling Procedure

Prior to emission sampling for each run, a single mold package containing four step cores of the binder formulation to be evaluated was placed onto a shake-out table contained within a hooded enclosure designed to meet the requirements of EPA Method 204 for a total temporary enclosure (TTE). The enclosed test stand was pre-heated to approximately 85° to 90° F. The flow rate of the emission capture air was nominally 600 scfm. Steel at approximately 2890 °F was then poured

through an opening in the top of the emission enclosure into the mold, after which the opening was closed (Figure 1-1). Sampling was initiated as soon as the molten steel contacted the mold surface.

Figure 1-1 Metal Pour into Mold through TTE



The emissions generated were transported through an insulated six (6) inch duct or stack located at the top of the enclosure. Heated sample probes inserted into the stack at relevant locations, determined by EPA Method 1, enabled collection of total emissions from all phases of the casting process. One probe in the stack was used to continuously draw effluent samples and transport them via a forty-seven (47) ft heated sample line to the FID for methane measurement, and to an emissions console (Figure 1-3) located in Technikon's laboratory. This console, or emissions bench, consists of a flame ionization detector based total hydrocarbon analyzer for TGOC analysis, two infrared analyzers (for CO and CO₂) and a chemiluminescence analyzer for NO_x.

Continuous air samples were collected during the twenty-five (25) minute pouring and cooling phase, during the five (5) minute shakeout of the mold, and for an additional twenty-five (25) minute cooling period following shakeout. The total sampling time was seventy-five (75) minutes.

Figure 1-1 Gas Analyzers in Emissions Bench



1.1.2. Process Parameter Measurements

Table 1-1 lists the process parameters that were measured and monitored during each pour of the test. The analytical equipment and methods used are also listed.

Table 1-1 Process Equipment and Methods

Process Parameter	Equipment and Method(s)
Mold Weight	Cardinal 748E Platform Scale (Gravimetric)
Casting Weight	Ohaus MP2 Scale
LOI, % at Mold	Denver Instruments XE-100 Analytical Scale (AFS Procedure 5100-00-S)
Metallurgical Parameters	
Pouring Temperature	Electro-Nite DT 260 (T/C Immersion Pyrometer)
Carbon/Silicon Fusion Temperature	Electro-Nite DataCast 2000 (Thermal Arrest)
Alloy Weights	Ohaus MP2 Scale (Gravimetric)
Carbon Silicon Ratio	Electro-Nite DataCast 2000 (Thermal Arrest)

1.1.3. Air Emissions Collection and Analysis

The specific sampling and analytical methods used during this and other emission tests are based on federal reference methods shown in Table 1-2.

Table 1-2 Emission Sampling and Analytical Methods

Measurement Parameter	Test Method(s)
Port Location	US EPA Method 1
Number of Traverse Points	US EPA Method 1
Gas Velocity and Temperature	US EPA Method 2
Gas Density and Molecular Weight	US EPA Method 3a
Gas Moisture	US EPA Method 4 (Gravimetric)
TGOC	US EPA Method 25A
CO	US EPA Method 10
CO ₂	US EPA Method 3A
NO _x	US EPA Method 7E
CH ₄	US EPA CTM 042

Some methods have been modified to meet sampling objectives

Data calculations for determining emission concentrations resulting from the specific test plan outlined in Appendix A are based on process and emission parameters. The analytical results of the emissions sampling provide the mass of each analyte in the sample. The total mass of the analyte emitted is calculated by multiplying the mass of analyte in the sample by the ratio of total stack gas volume to sample volume. The total stack gas volume is calculated from the measured stack gas velocity and duct diameter and corrected to dry standard conditions using the measured stack pressures, temperatures, gas molecular weight and moisture content. The total mass of analyte is then divided by the weight of the casting poured or weight of binder to provide emissions data in pounds of analyte per ton of metal or pounds of analyte per pound of binder.

Individual concentration and reporting limit results for each analyte for all sampling runs for all three binder formulations are included in Appendix B of this report. Average results for the tests are given in Section 2.0, Table 2-1a and 2-1b.

Detailed QA/QC and data validation procedures for the process parameters, stack measurements, and laboratory analytical procedures are included in the “Technikon Emissions Testing and Analytical Testing Standard Operating Procedures” publication. The timely review of critical quality control parameters is ensured by the following procedures:

- Immediately following the individual sampling events performed for each run of the test, specific process parameters were reviewed by the Process Engineer to ensure that the parameters were maintained within the prescribed control ranges. Where data were not within the prescribed ranges, the Manager of Process Engineering and the Vice President of Operations determined whether the individual test samples should be invalidated or flagged for further analysis following review of the laboratory data.

- The source (stack) and sampling parameters, analytical results and corresponding laboratory QA/QC data are reviewed by the Emissions Measurement Team to confirm the validity of the data. Senior management of Analytical Measurement Technologies reviews and approves the recommendation, if any, that individual sample data should be invalidated. Invalidated data are not used in subsequent calculations.

2.0 RESULTS AND DISCUSSION

Total hydrocarbons present in the gas emissions were determined by Method 25A, and are termed TGOC as Propane. The NMHC were determined by a procedure similar to that found in historic EPA CTM-042.

The average airborne hydrocarbon and methane emissions results from the pouring, cooling and shakeout processes investigated for Test HW are presented in Tables 2-1a and 2-1b, as lb/ton metal and lb/lb binder, respectively. Detailed results for each pour of the test are included in Appendix B, as are the reporting limits for each analyte.

Table 2-1a Average Hydrocarbon Emissions, Test HZ, lb/ton metal

	Techniset F6073/6435		Techniset F6073/6636		Techniset F6073/6636T	
	Average	Std Dev	Average	Std Dev	Average	Std Dev
TGOC as Propane	1.04	0.35	0.90	0.05	0.90	0.10
NMHC	0.90	0.29	0.74	0.05	0.76	0.09

Table 2-1b Average Hydrocarbon Emissions, Test HZ, lb/lb binder

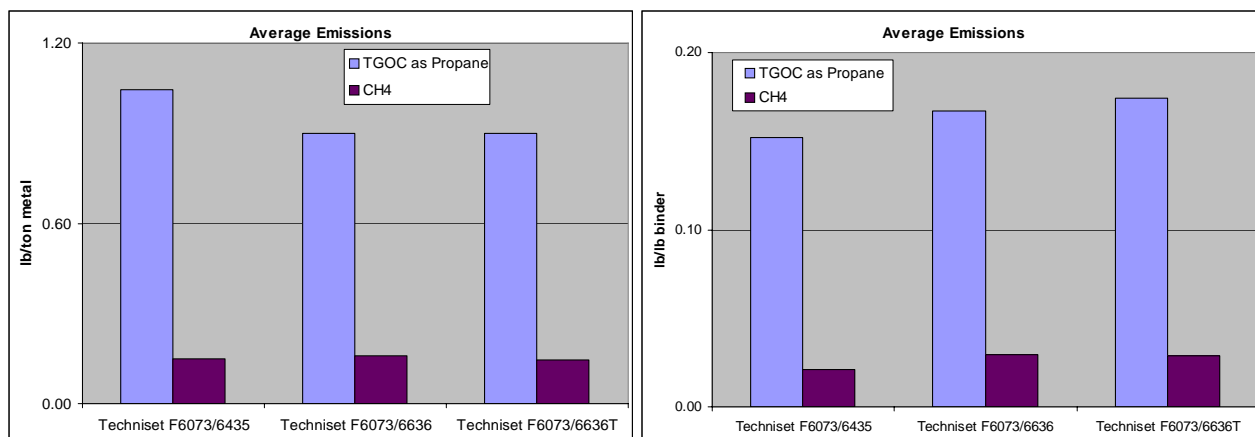
	Techniset F6073/6435		Techniset F6073/6636		Techniset F6073/6636T	
	Average	Std Dev	Average	Std Dev	Average	Std Dev
TGOC as Propane	0.15	0.03	0.17	0.02	0.17	0.02
NMHC	0.13	0.02	0.14	0.01	0.15	0.02

Presented data have been background corrected. Background correcting the data allows determination of the emissions resulting only from the specific material being tested, and not those that may be present in either the ambient air of the research foundry during the testing period or the instrumentation and equipment used during analysis. When sample measurements are made, the

observed result includes the contribution of the analyte in the sample, plus a response due to the background contribution found from the blank. The net analyte sample concentration is therefore the amount of the analyte, if any, found in the blank subtracted from the amount of analyte found in the sample.

Figure 2-1 shows the average emission results for total hydrocarbon and methane as bar charts.

Figure 2-1 Average Hydrocarbon Emissions, Test HZ



Examination of measured process parameters indicated that Test HZ was run within acceptable ranges and limits. The principal causes and secondary influences on emissions were identified, corrected, controlled, and monitored as much as feasibly possible for each individual run. This ensured that emissions produced during the test reflected only the influence of the material being tested and not the process itself.

The average process parameters measured and recorded for Test HZ are reported in Table 2-2.

Table 2-2 Summary of Test Plan Average Process Parameters

Parameter Measured	Averages
Cast weight, lbs.	119.22
Pouring time, sec.	14.22
Pouring temp , °F	2886.00
Pour hood process air temp at start of pour, °F	86.63
CORE	
Mixer auto dispensed sand weight, lbs	12.51
Core Binder Weight Part 1, g	38.77
Core Binder Weight Part 2, g	24.97
Core binder weight, g	63.74
% core binder (BOS)	1.12
% core binder, actual	1.11
Total core weight in mold, lbs.	30.03
Total binder weight in mold, lbs.	0.33
Core LOI, %	
MOLD	
Muller batch weight, lbs.	1195.61
GS mold sand weight, lbs.	1009.56
Mold temperature, °F	82.54
GS compactability, %	58.67
Sand temperature, °F Note 2	102.46



MATERIAL SAFETY DATA SHEET

FOR INDUSTRIAL USE ONLY

DESCRIPTION: Techniset® 6073 UNB Pt1

1. Chemical Product and Company Identification

DESCRIPTION: **Techniset® 6073 UNB Pt1**
 PRODUCT CODE: 339781
 PRODUCT TYPE: Liquid Phenolic Resin
 APPLICATION: Urethane No Bake System

Manufacturer/Supplier Information

MSDS prepared by:
 HA International, LLC
 630 Oakmont Lane
 Westmont, IL
 60559

For Emergency Medical Assistance
 Call Health & Safety Information Services
 1-866-303-6949

For additional health and safety or regulatory information, call (630)575-5722, or (630)575-5705.

2. Composition, Information on Ingredients

The ingredients listed below have been associated with one or more immediate and/or delayed(*) health hazards. Risk of damage and effects depends upon duration and level of exposure. BEFORE USING, HANDLING, OR EXPOSURE TO THESE INGREDIENTS, READ AND UNDERSTAND THE MSDS.

		% by weight
	Mixture of Dimethyl Succinate, Glutarate and Adipate (CAS Numbers 106-65-0, 1119-40-0 and 627-93-0)	10.0 - 30.0
64742-95-6	Light Aromatic Solvent Naphtha (petroleum)	1.0 - 5.0
108-95-2	*Phenol	1.0 - 5.0
95-63-6	1,2,4-Trimethylbenzene	1.0 - 5.0
108-32-7	Propylene Carbonate	1.0 - 5.0
103-23-1	Di(2-Ethylhexyl) Adipate	1.0 - 5.0

Any applicable Canadian trade secret numbers will be listed in Section 15.2.

3. Hazards Identification

3.1 Emergency Overview

Appearance: Amber hazy liquid
 Odor: Aromatic hydrocarbon

CAUTION!

COMBUSTIBLE

Overexposure may cause central nervous system effects. May cause irritation of nose, throat

and lungs if allowed to become airborne.
Causes eye irritation.

NORTH AMERICAN EMERGENCY RESPONSE GUIDE, 2000, NO: 128

HMIS Rating

HEALTH	=	2 (moderate)
FLAMMABILITY	=	2 (moderate)
REACTIVITY	=	0 (minimal)
CHRONIC	=	*

3.2 Potential Health Effects

Immediate Hazards

INGESTION:	Not expected to be harmful under normal conditions of use.
INHALATION:	Not expected to be harmful under normal conditions of use. However, overexposure may cause central nervous system effects. Also, if allowed to become airborne, may cause irritation of nose, throat and lungs.
SKIN:	May cause irritation on prolonged or repeated contact.
EYES:	Causes irritation.

108-95-2 Phenol

Can cause central nervous system effects. Signs and symptoms may include headache, dizziness, nausea, vomiting, motor difficulties and unconsciousness.

95-63-6 1,2,4-Trimethylbenzene

Can cause central nervous system depression. Signs and symptoms may include headache, dizziness, nausea, vomiting and drowsiness.

64742-95-6 Light Aromatic Solvent Naphtha (petroleum)

Can cause central nervous system depression. Signs and symptoms may include headache, dizziness, nausea, vomiting, unconsciousness and even asphyxiation.

Delayed Hazards

108-95-2 Phenol

Can cause liver and kidney damage. Signs and symptoms of chronic poisoning may include vomiting, difficulty in swallowing, diarrhea, lack of appetite, jaundice, fatigue, bleeding or easy bruising and sometimes pain and swelling in the upper right abdomen, changes in urine output or dark urine, pain upon urination or in the lower back, or general edema. Can also cause cardiac damage evidenced by shortness of breath and in severe cases cardiac arrest. Preexisting medical conditions of the heart, kidney, liver, lung, eyes and skin may be aggravated by exposure.

-- See Footnote

Footnote: As of the date of issuance of this document, this material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

4. First Aid Measures

INGESTION:	If accidentally swallowed, dilute by drinking large quantities of water. If the individual is drowsy or unconscious, do not give anything by mouth. Immediately contact poison control center or hospital emergency room for advice on whether to induce vomiting or for any other additional treatment directions.
INHALATION:	Remove to fresh air.
SKIN:	In case of irritation, flush with water.
EYES:	Immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held apart during irrigation to ensure water contact with entire surface of eyes and lids. Call a physician.

5. Fire Fighting Measures

Flash point	46.66 °C (115.99 °F) Tag Closed Cup ASTM D 56 (Solvent)
Lower explosion limit	Not available
Upper explosion limit	Not available
Autoignition temperature	Not available

COMBUSTIBLE. Keep away from heat and flame.

In case of fire, use dry chemical, foam or CO₂. Water may be ineffective, but should be used to keep fire-exposed containers cool.

6. Accidental Release Measures

Eliminate all ignition sources. Contain and/or absorb spill with inert material (e.g. sand, vermiculite), then place in a suitable container. For large spills, use water spray to disperse vapors and flush spill area. Prevent runoff from entering waterways or sewers. Use appropriate Personal Protective Equipment (PPE).

7. Handling and Storage

7.1 Handling

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of the material from eyes, skin and clothing. Wash thoroughly after handling. Always use appropriate Personal Protective Equipment (PPE).

INHALATION:	Avoid prolonged or repeated breathing of vapor.
SKIN:	Avoid prolonged or repeated contact with skin and clothing.
EYES:	Avoid contact with eyes.

7.2 Storage

Keep container out of sun and away from heat.
 Empty container may contain product residues. DO NOT cut, torch or reuse without commercial cleaning.
 Never use air pressure to empty containers.
 Do not use air to unload bulk trucks. Unload using pumps or an inert gas, such as nitrogen.
 Keep away from heat, sparks, flame and other ignition sources.
 Store at ambient temperature.
 Use with adequate ventilation.
 Keep away from acids.
 Store in a tightly closed container.

8. Exposure Controls/Personal Protection

8.1 Exposure Controls

ENGINEERING CONTROLS: The following exposure control techniques may be used to effectively minimize employee exposure: local exhaust ventilation, enclosed system design, process isolation and remote control in combination with appropriate use of personal protective equipment and prudent work practices. These techniques may not necessarily address all issues pertaining to your operations. We, therefore, recommend that you consult with experts of your choice to determine whether or not your programs are adequate.

If airborne contaminants are generated when the material is heated or handled, sufficient ventilation in volume and air flow patterns should be provided to keep air contaminant concentration levels below acceptable criteria.

8.2 Personal Protection

Where air contaminants can exceed acceptable criteria, use NIOSH (42 CFR Part 84) approved respiratory protection equipment. Respirators should be selected based on the form and concentration of contaminants in air in accordance with OSHA laws and regulations or other applicable standards or guidelines, including ANSI standards regarding respiratory protection. Use goggles if contact is likely. Wear impervious gloves as required to prevent skin contact.

8.3 Exposure Guidelines

Mixture of Dimethyl Succinate, Glutarate and Adipate (CAS Numbers 106-65-0, 1119-40-0 and 627-93-0)				
ACGIH TLV	None established			
OSHA PEL	None established			
64742-95-6	Light Aromatic Solvent Naphtha (petroleum)			
ACGIH TLV	8-hr TWA	100 ppm	525 mg/m3	as Stoddard Solvent
OSHA PEL	8-hr TWA	500 ppm	2,900 mg/m3	as Stoddard Solvent
	Remanded TWA	100 ppm	525 mg/m3	as Stoddard Solvent; 1989 PEL remanded, but in effect in some states
VENDOR OEL	8-hr TWA	19 ppm	100 mg/m3	(as total hydrocarbons)
108-95-2	Phenol			
ACGIH TLV	8-hr TWA	5 ppm	19 mg/m3	Skin

OSHA PEL 95-63-6	8-hr TWA 1,2,4-Trimethylbenzene	5 ppm	19 mg/m3	Skin
ACGIH TLV OSHA PEL	8-hr TWA None Established Remanded TWA	25 ppm	123 mg/m3	(as Trimethylbenzene)
108-32-7	Propylene Carbonate	25 ppm	125 mg/m3	(as Trimethylbenzene); 1989 PEL remanded, but in effect in some states
ACGIH TLV OSHA PEL	None established None established			
103-23-1	Di(2-Ethylhexyl) Adipate			
ACGIH TLV OSHA PEL	None established None established			

9. Physical and Chemical Properties

Appearance	Amber hazy liquid
Odor	Aromatic hydrocarbon
Odor threshold	Not available
Specific gravity	1.09
pH	Not applicable
Viscosity	130 cPs Brookfield
Solubility in water	Insoluble
Octanol/water partition coefficient	Not available
Vapor pressure	Not available
Vapor density	Not available
Evaporation rate	Not available
Boiling point, 760 mm Hg	Not available

10. Stability and Reactivity

Normally stable as defined in NFPA 704-12(4-3.1).

Incompatibilities:

Oxidizers, acids

Decomposition products may include:

CO, CO₂, aldehydes (including formaldehyde), phenols, hydrogen cyanide, ammonia, particulate matter and other organic compounds including benzo[a]pyrene.

Hazardous polymerization:

Will not occur.

Other Hazards:

During core/mold making, vapors of phenol and/or substituted phenols, formaldehyde and hydrocarbons may be released.

11. Toxicological Information

INGESTION: A similar product was found to have an LD₅₀ >0.5 g/kg when tested as

described in 16 CFR Part 1500.3 (c)(1) and (2).

INHALATION:	A similar product was found to be non-toxic by inhalation when tested as described in 16 CFR Part 1500.3 (c)(1) and (2).
SKIN ABSORPTION:	A similar product was found to be non-toxic dermally when tested as described in 16 CFR Part 1500.3 (c)(1) and (2).
SKIN:	A similar product was not a primary irritant (primary skin irritation index less than 5.0/8.0) when tested as described in 16 CFR Part 1500.41.
EYES:	A similar product was moderately irritating when tested as described in 16 CFR Part 1500.42.

Mixture of Dimethyl Succinate, Glutarate and Adipate (CAS Numbers 106-65-0, 1119-40-0 and 627-93-0)

LC50: Not available

LD50: Not available

64742-95-6 Light Aromatic Solvent Naphtha (petroleum)

LC50: Not available

LD50: Not available

108-95-2 Phenol

LC50: rat=0.316 mg/l (RTECS)

LD50: Oral-rat= 414 mg/kg (Sax); Skin-rabbit= 850 mg/kg (Sax)

95-63-6 1,2,4-Trimethylbenzene

LC50: rat=/4 h (Sax)

LD50: Oral-rat= 5,000 mg/kg (Sax)

108-32-7 Propylene Carbonate

LC50: Not available

LD50: Oral-mice= 20,700 mg/kg (Sax) LD50: Oral-rat=Greater than 5,000 mg/kg (vendor);

Skin-rabbit=Greater than 2,000 mg/kg (vendor)

103-23-1 Di(2-Ethylhexyl) Adipate

LC50: Not available

LD50: Not available

12. Ecological Information

No data for ecotoxicity has been found. Effects are expected to be minimal. Phenol-formaldehyde polymers have a very low rate of biodegradation. Bioaccumulation is expected to be minimal. Product is initially a mobile liquid which will solidify on aging. Unreacted monomer may be leached into ground water even after normal curing has occurred.

13. Disposal Considerations

Recover free liquid. Absorb residue and dispose of according to local, state/provincial, and federal requirements. Empty container: May contain explosive vapors. DO NOT cut, puncture or weld on or nearby.

14. Transport Information

14.1 U.S. Department of Transportation (DOT)

The data provided in this section is for information only and may not be specific to your package size. You will need to apply the appropriate regulations to properly classify your shipment for transportation.

Proper shipping name COMBUSTIBLE LIQUID, N.O.S. (Petroleum Naphtha)

UN/NA number 1993
Class N/A
Packing group III
Label
RQ Ingredients

14.2 Canadian Transportation of Dangerous Goods (TDG)

Regulation: Non regulated

15. Regulatory Information (Selected Regulations)

15.1 U.S. Federal Regulations

OSHA Hazards Communication Standard 29CFR1910.1200

This material is a "health hazard" and/or a "physical hazard" as determined when reviewed according to the requirements of the Occupational Safety and Health Administration 29 CFR Part 1910.1200 "Hazard Communication" Standard.

SARA Title III: Section 311/312

Immediate health hazard
Delayed health hazard
Fire hazard

SARA Title III: Section 313 and 40 CFR Part 372

This product contains the following toxic chemical(s) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986, and Subpart C-Supplier Notification Requirement of 40 CFR Part 372.

1,2,4-Trimethylbenzene	95-63-6	2.49%
Phenol	108-95-2	4.28%

TSCA Section 8(b) Inventory

All reportable chemical substances are listed on the TSCA Inventory. We rely on certifications of compliance from our suppliers for chemical substances not manufactured by us.

15.2 Canadian Regulations

Workplace Hazardous Materials Information System (WHMIS)

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation (CPR) and the MSDS contains all the information required by the CPR.

Class B3
Class D2A
Class D2B

Canadian Environmental Protection Act (CEPA)

All reportable chemical substances are listed on the Domestic Substances List (DSL) or otherwise comply with CEPA new substance notification requirements.

National Pollutant Release Inventory (NPRI)

This product contains the following chemical(s) subject to the reporting requirements of the Canadian Environmental Protection Act (CEPA) subsection 16(1), National Pollutant Release Inventory.

1,2,4-Trimethylbenzene	95-63-6	2.49%
Bis(2-Ethylhexyl) adipate	103-23-1	1.00%
Phenol (and its salts)	108-95-2	4.28%

16. Other Information

User's Responsibility

The OSHA Hazard Communication Standard 29CFR 1910.1200 and the Workplace Hazardous Materials Information System (WHMIS) require that the information contained on these sheets be made available to your workers. Educate and train your workers regarding OSHA and WHMIS precautions. Instruct your workers to handle this product properly. Consult with appropriate experts to guard against hazards associated with use of this product and its ingredients.

Disclaimer

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE, except that the product shall conform to contracted specifications, and that the product does not infringe any valid United States or Canadian patent. No claim of any kind shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.



MATERIAL SAFETY DATA SHEET

FOR INDUSTRIAL USE ONLY

DESCRIPTION: Techniset® 6435 UNB Pt2

1. Chemical Product and Company Identification

DESCRIPTION: Techniset® 6435 UNB Pt2
PRODUCT CODE: 338916
PRODUCT TYPE: Liquid Isocyanate Resin
APPLICATION: Urethane No Bake System

Manufacturer/Supplier Information

MSDS prepared by:
HA International, LLC
630 Oakmont Lane
Westmont, IL
60559

For Emergency Medical Assistance
Call Health & Safety Information Services
1-866-303-6949

For additional health and safety or regulatory information, call (630)575-5722, or (630)575-5705.

2. Hazards Identification

2.1 Emergency Overview

Appearance	Dark brown to black liquid
Odor	Hydrocarbon solvent

WARNING!

COMBUSTIBLE LIQUID

May become unstable at high temperatures or may react with water.

Hazardous polymerization may occur.

Harmful if inhaled. If material is heated, sprayed or otherwise dispersed, may cause irritation of nose, throat and lungs.

Can cause central nervous system depression.

May cause allergic respiratory reaction.

Causes eye irritation.

May be harmful if swallowed.

Causes skin irritation.

May cause allergic skin reaction.

NORTH AMERICAN EMERGENCY RESPONSE GUIDE, 2000, NO: 128

HMIS Rating

HEALTH	=	3 (serious)
FLAMMABILITY	=	2 (moderate)
REACTIVITY	=	1 (slight)
CHRONIC	=	*

HMIS® ratings involve data interpretations that may vary from company to company. They are intended only for the rapid, general identification of the magnitude of the specific hazard. To deal adequately with the safe handling of this material, all the information contained in this MSDS must be considered.

2.2 Potential Health Effects

Immediate Hazards

- INGESTION:** May be harmful if swallowed.
If accidentally swallowed, burns or irritation to mucous membranes, esophagus or GI tract can result.
- INHALATION:** Harmful if inhaled. If material is heated, sprayed or otherwise dispersed, may cause irritation of nose, throat and lungs. Exposures to concentrations below the exposure guidelines may cause allergic respiratory reactions in individuals already sensitized. Symptoms may include coughing, difficult breathing and a feeling of tightness in the chest. Effects may be delayed.
- SKIN:** Can cause central nervous system depression.
Skin contact may result in allergic skin reactions or respiratory sensitization. However, it is not expected to result in absorption of amounts sufficient to cause other adverse effects. Isocyanates react with skin protein and moisture and can cause irritation. Cured material is difficult to remove.
- EYES:** Causes irritation.

91-20-3 Naphthalene

Can cause central nervous system depression. Signs and symptoms may include headache, dizziness, nausea, vomiting, unconsciousness and even asphyxiation.

64742-94-5 Heavy Aromatic Solvent Naphtha (petroleum)

Can cause central nervous system depression. Signs and symptoms may include headache, dizziness, nausea, vomiting, unconsciousness and even asphyxiation.

Delayed Hazards

91-20-3 Naphthalene

POSSIBLE CANCER HAZARD. May cause cancer based on animal data. This material has been classified by IARC as an animal carcinogen (Group 2B). This material is not listed by NTP nor regulated by OSHA as a carcinogen.

May cause allergic skin reaction.

Can cause liver damage.

Can cause blood disorder.

Can cause kidney damage.

101-68-8 Diphenylmethane 4,4'-Diisocyanate (MDI)

Lung tumors have been observed in laboratory animals exposed to aerosol droplets of diphenylmethane 4,4'-diisocyanate (MDI)/polymeric MDI (6 mg/m³) for their lifetime. Tumors occurred concurrently with respiratory irritation and lung injury. This material has not been listed by NTP, classified by IARC, nor regulated by OSHA as a carcinogen.

Repeated exposure or a single large exposure may cause isocyanate sensitization (chemical asthma). Once sensitized, individuals may react to a later exposure at levels well below the applicable exposure limits. These symptoms, which can include chest tightness, wheezing, cough, shortness of breath or asthmatic attack, could be immediate or delayed up to several hours after exposure. There are reports that once sensitized, symptoms may occur upon exposure to dust, cold air or other irritants. Sensitization can either be temporary or permanent.

Chronic overexposure to isocyanates has also been reported to cause lung damage (including fibrosis, decrease in lung function) which may be permanent. Preexisting asthma and other respiratory disorders (bronchitis, emphysema, hyperreactivity) may be aggravated by exposure.

9016-87-9 Polymeric Diphenylmethane Diisocyanate

See hazards listed above for MDI (CAS# 101-68-8).

-- See Footnote at end of section

26447-40-5 Isocyanic Acid, Methylenediphenylene Ester

See hazards listed above for MDI (CAS# 101-68-8).

-- See Footnote at end of section

68648-87-3 Benzene, C10-16-alkyl Derivs.

Dodecylbenzene, a component of this material, has been used as a vehicle and solvent for polynuclear aromatics in carcinogenesis studies and may enhance the tumorigenic potential of known carcinogens. Mice exposed chronically to alkylbenzenes had increases in lymphomas and skin tumors. Significant skin damage was present at the levels used in these studies. This material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

Rats exhibited decreased body weights and food consumption following repeated exposures administered in their feed. Overexposure by inhalation resulted in eye and nose irritation, reduced body weights, some organ weight changes and a loss of abdominal fat in rats and mice. Similar exposures for a longer period resulted in reduced body weight gains and produced liver toxicity (only at the highest exposure level) and various signs of irritation. An increase in minor skeletal birth defects was observed in offspring of rats exposed to this material orally during pregnancy, but only at an amount which produced adverse effects on the mothers and their offspring. Reductions in litter size and viability, survival and weights of pups occurred at dose levels producing parental toxicity when ingested for two successive generations. No genetic changes were produced in standard tests using animals and animal or bacterial cells.

64742-81-0 Hydrodesulfurized Kerosine (petroleum)

POSSIBLE CANCER HAZARD. May cause cancer based on animal data. This material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

8008-20-6 Kerosine

POSSIBLE CANCER HAZARD. May cause cancer based on animal data. This material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

64742-47-8 Hydrotreated Light Distillate (petroleum)

POSSIBLE CANCER HAZARD. May cause cancer based on animal data. This material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

Footnote: As of the date of issuance of this document, this material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

3. Composition, Information on Ingredients

The ingredients listed below have been associated with one or more immediate and/or delayed(*) health hazards. Risk of damage and effects depends upon duration and level of exposure. BEFORE USING, HANDLING, OR EXPOSURE TO THESE INGREDIENTS, READ AND UNDERSTAND THE MSDS.

		% by weight
9016-87-9	*Polymeric Diphenylmethane Diisocyanate	30.0 - 50.0
101-68-8	*Diphenylmethane 4,4'-Diisocyanate (MDI)	10.0 - 30.0
64742-94-5	Heavy Aromatic Solvent Naphtha (petroleum)	10.0 - 30.0
26447-40-5	*Isocyanic Acid, Methylenediphenylene Ester	5.0 - 10.0
68648-87-3	*Benzene, C10-16-alkyl Derivs.	5.0 - 10.0
91-20-3	*Naphthalene	1.0 - 5.0
64742-47-8	*Hydrotreated Light Distillate (petroleum)	0.1 - 1.0
8008-20-6	*Kerosine	0.1 - 1.0
64742-81-0	*Hydrosulfurized Kerosine (petroleum)	0.1 - 1.0

Any applicable Canadian trade secret numbers will be listed in Section 15.2.

4. First Aid Measures

INGESTION:	If accidentally swallowed, dilute by drinking large quantities of water. If the individual is drowsy or unconscious, do not give anything by mouth. Immediately contact poison control center or hospital emergency room for advice on whether to induce vomiting or for any other additional treatment directions.
INHALATION:	If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Asthmatic-type symptoms may develop and may be immediate or delayed up to several hours. Treatment is essentially symptomatic. Call a physician. Any individual having a dermal or pulmonary sensitization reaction to this material must be removed from any further exposure to any isocyanate.
SKIN:	Immediately wash with soap and plenty of water for at least 15 minutes while removing contaminated clothing. Call a physician if symptoms occur. Wash clothing before reuse.
EYES:	Immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held apart during irrigation to ensure water contact with entire surface of eyes and lids. Call a physician.

5. Fire Fighting Measures

Suitable Extinguishing Media: In case of fire, use dry chemical, foam or CO₂; use water spray for large fires.

COMBUSTIBLE LIQUID. Keep away from heat and flame.

Wear full emergency protective equipment including NIOSH approved pressure demand self-contained breathing apparatus. Isocyanate vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Reacts with water to produce CO₂. Water contamination can cause rupture of closed containers. Cool fire-exposed containers with cold-water spray to minimize risk of rupture.

6. Accidental Release Measures

Eliminate all ignition sources. Evacuate area of all persons not wearing proper protective equipment. If indoors, ventilate area. If product is on the ground, dike area to prevent entry into water systems and soil. Wear full protective equipment including respiratory equipment during clean-up. If temporary control of isocyanate vapor is required, a blanket of protein foam (available at most fire departments) may be spread. Contain and/or absorb spill with inert material (e.g. sand, vermiculite), place in a suitable unsealed container, transport to well-ventilated area (outside) and treat with neutralizing solution: mixture of water (80%) with non-ionic surfactant Tergitol TMN-10 (20%), or; water (90%), concentrated ammonia (3-8%) and liquid detergent (2%). Add about 10 parts of neutralizer per one part of isocyanate, with mixing. Allow to stand uncovered for 48 hours to let CO₂ escape.

7. Handling and Storage

7.1 Handling

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of the material from eyes, skin and clothing. Wash thoroughly after handling. Always use appropriate Personal Protective Equipment (PPE).

INHALATION: Do not breathe aerosols or vapors. Warning properties (irritation of the eyes, nose and throat or odor) are not adequate to prevent chronic overexposure from inhalation. This material can produce asthmatic sensitization upon either single inhalation exposure to a relatively high concentration or upon repeated inhalation exposures to lower concentrations.

SKIN: Avoid contact with skin and clothing.

EYES: Avoid contact with eyes.

Do not allow containers to be heated above recommended storage temperatures because they can be pressurized and possibly rupture. Exposure to vapors of heated isocyanate can be dangerous. Employee education and training in the safe use and handling of isocyanates is required.

7.2 Storage

Never use air pressure to empty containers.
Do not use air to unload bulk trucks. Unload using pumps or an inert gas, such as nitrogen.
Use with adequate ventilation.
Will react with water. Keep tightly closed and dry.
Do not store near strong oxidizing chemicals.

8. Exposure Controls/Personal Protection

8.1 Exposure Guidelines

9016-87-9	Polymeric Diphenylmethane Diisocyanate
ACGIH TLV	None established
OSHA PEL	None established
101-68-8	Diphenylmethane 4,4'-Diisocyanate (MDI)

ACGIH TLV	8-hr TWA	0.005 ppm		
OSHA PEL	Ceiling	0.02 ppm		
64742-94-5	Heavy Aromatic Solvent Naphtha (petroleum)			
ACGIH TLV	None			
	Established			
OSHA PEL	8-hr TWA	5 mg/m3		Oil mist, mineral
26447-40-5	Isocyanic Acid, Methylenediphenylene Ester			
ACGIH TLV	None			
	Established			
OSHA PEL	None			
	Established			
68648-87-3	Benzene, C10-16-alkyl Derivs.			
ACGIH TLV	None established			
OSHA PEL	None established			
91-20-3	Naphthalene			
ACGIH TLV	8-hr TWA	10 ppm	52 mg/m3	Skin
	STEL (15 min)	15 ppm	79 mg/m3	
OSHA PEL	8-hr TWA	10 ppm	50 mg/m3	
	Remanded	15 ppm	75 mg/m3	
	STEL			
64742-47-8	Hydrotreated Light Distillate (petroleum)			
ACGIH TLV	8-hr TWA	200 mg/m3		Skin; A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
				Oil mist, mineral
OSHA PEL	None			
	Established			
8008-20-6	Kerosine			
ACGIH TLV	8-hr TWA	200 mg/m3		Skin; as total hydrocarbon vapor; A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
OSHA PEL	None			
	Established			
64742-81-0	Hydrodesulfurized Kerosine (petroleum)			
ACGIH TLV	8-hr TWA	200 mg/m3		Skin; as total hydrocarbon vapor; A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
OSHA PEL	None			
	Established			

8.2 Exposure Controls

ENGINEERING CONTROLS: The following exposure control techniques may be used to effectively minimize employee exposure: local exhaust ventilation, enclosed system design, process isolation and remote control in combination with appropriate use of personal protective equipment and prudent work practices. These techniques may not necessarily address all issues pertaining to your operations. We, therefore, recommend that you consult with experts of your choice to determine whether or not your programs are adequate.

If airborne contaminants are generated, sufficient ventilation in volume and air flow patterns should be provided to keep air contaminant concentration levels below acceptable criteria.

8.3 Personal Protection

Wear synthetic apron and boots if contact is likely. Where air contaminants can exceed acceptable criteria, use NIOSH (42 CFR Part 84) air supplied approved respiratory protection equipment. Respirators should be selected based on the form and concentration of contaminants in air in accordance with OSHA laws and regulations or other applicable standards or guidelines, including ANSI standards regarding respiratory protection. OSHA permits other NIOSH respirators (negative pressure type) under specified conditions. Use goggles and face shield if contact is likely. Wear permeation resistant gloves (butyl rubber, nitrile rubber, neoprene) as required to prevent skin contact. Cover as much of the exposed skin area as possible with appropriate clothing.

MEDICAL SURVEILLANCE: Medical supervision of all employees who handle or come in contact with isocyanates is recommended. These should include preemployment and periodic medical examinations with pulmonary respiratory allergies such as hay fever, eczema, history of prior isocyanate sensitization, or lack of smell (anosmia) are possible reasons for medical exclusion from isocyanate areas. Once a person is accurately diagnosed as sensitized to an isocyanate, no further exposure can be permitted.

9. Physical and Chemical Properties

Appearance	Dark brown to black liquid
Odor	Hydrocarbon solvent
Odor threshold	Not available
pH	Not applicable
Boiling point, 760 mm Hg	Not available
Flash point	72 °C (162 °F) Tag Closed Cup ASTM D 56
Evaporation rate	Not available
Lower explosion limit	0.7 % (V)(Solvent)
Upper explosion limit	5 % (V)(Solvent)
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.13
Solubility in water	Insoluble
Octanol/water partition coefficient	Not available
Autoignition temperature	Not available
Viscosity	40 cPs Brookfield

10. Stability and Reactivity

Chemical Stability

Normally stable. Contact with moisture or other materials that react with isocyanates, or temperatures above 350°F (177°C) may cause polymerization. Product may form carbon dioxide which will cause a build-up of pressure in closed containers causing a possible hazardous rupture.

Conditions to avoid

High heat and moisture.

Incompatible Materials

Water, alcohols, amines, bases and direct UV.
Strong oxidizers, reducing agents, acids and alkaline materials.

Hazardous Decomposition Products

CO, CO₂, aldehydes (including formaldehyde), phenols, hydrogen cyanide, ammonia, particulate matter and other organic compounds including benzo[a]pyrene.

Possibility of Hazardous Reactions

Hazardous polymerization may occur.

Other Hazards

During core/mold making, vapors of hydrocarbons and 4,4'-diphenylmethane diisocyanate may be released.

11. Toxicological Information

See Section 3 Hazards Identification information.

9016-87-9 Polymeric Diphenylmethane Diisocyanate

LC50: rat=0.490 mg/l/4 h (vapor)

LD50: Oral-rat=Greater than 10,000 mg/kg (Sax); Skin-rabbit=Greater than 9,400 mg/kg (Sax)

101-68-8 Diphenylmethane 4,4'-Diisocyanate (MDI)

LC50: rat=0.178 mg/l (RTECS)

LD50: Oral-muskrat= 2,200 mg/kg (RTECS); Skin-rabbit=Greater than 10,000 mg/kg (vapor)

64742-94-5 Heavy Aromatic Solvent Naphtha (petroleum)

LC50: Not available

LD50: Not available

26447-40-5 Isocyanic Acid, Methylenediphenylene Ester

LC50: Not available

LD50: Not available

68648-87-3 Benzene, C10-16-alkyl Derivs.

LC50: Not available

LD50: Oral-rat= 17,000 mg/kg (vapor); Skin-rabbit=Greater than 10,200 mg/kg (vapor)

91-20-3 Naphthalene

LC50: Not available

LD50: Oral-rat= 1,250 mg/kg (RTECS)

64742-47-8 Hydrotreated Light Distillate (petroleum)

LC50: rat=21.4 mg/l/4 h (vapor)

LD50: Not available

8008-20-6 Kerosine

LC50: rat=2 mg/l/4 h (vapor)

LD50: Oral-rat=Greater than 5,000 mg/kg (Sax)

64742-81-0 Hydrodesulfurized Kerosine (petroleum)

LC50: Not available

LD50: Oral-rat=Greater than 5,000 mg/kg (Sax); Skin-rabbit=Greater than 2,000 mg/kg (Sax)

12. Ecological Information

Mono- and poly-diphenylmethane diisocyanates react readily with water to form insoluble polyureas. Therefore, no ecotoxicity data for the isocyanates is available. The monomer degrades photochemically in air with an estimated half-life of 32 hours. Leaching from soil is not environmentally important. Bioconcentration in carp does not occur over an eight week period.

13. Disposal Considerations

Dispose of according to local, state/provincial, and federal requirements. Incineration is the preferred method. Empty container: Empty containers retain product residue and may contain explosive vapors. Observe all precautions for product. DO NOT heat, weld or cut empty container with electric or gas torch because highly toxic and/or explosive vapors and gases are formed. Do not reuse without thorough commercial cleaning and reconditioning. If container is to be disposed, ensure all product residues are removed prior to disposal.

14. Transport Information

14.1 U.S. Department of Transportation (DOT)

The data provided in this section is for information only and may not be specific to your package size or mode of transport. You will need to apply the appropriate regulations to properly classify your shipment for transportation.

Proper shipping name	COMBUSTIBLE LIQUID, N.O.S. (Petroleum Distillates,)
UN/NA number	1993
Class	N/A
Packing group	III
Label	
RQ Ingredients	Naphthalene, Diphenylmethane 4,4'-Diisocyanate (MDI)

The above shipping description applies to the largest container size currently used for this product. Other potential shipping descriptions applicable to this product are given below.

When packaged in intermediate bulk containers (IBCs or totes):

Combustible liquid, n.o.s. (Petroleum Distillate), NA1993, III

When packaged in non-bulk containers:

Non-regulated

14.2 Canadian Transportation of Dangerous Goods (TDG)

Regulation:	Non regulated
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14.3 Other Regulations

- **ADR/RID**
Regulation: Non regulated
- **IMO/IMDG**
Regulation: Non regulated
- **IATA (Passenger)**
Regulation: Non regulated

15. Regulatory Information (Selected Regulations)

15.1 U.S. Federal Regulations

OSHA Hazards Communication Standard 29CFR1910.1200

This material is a "health hazard" and/or a "physical hazard" as determined when reviewed according to the requirements of the Occupational Safety and Health Administration 29 CFR Part 1910.1200 "Hazard Communication" Standard.

SARA Title III: Section 311/312

Immediate health hazard
Delayed health hazard
Fire hazard
Reactivity hazard

SARA Title III: Section 313 and 40 CFR Part 372

This product contains the following toxic chemical(s) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986, and Subpart C-Supplier Notification Requirement of 40 CFR Part 372.

Naphthalene	91-20-3	1.76%
Methylenebis(4-phenylisocyanate) (MDI)	N120	27.28%
Polymeric Diphenylmethane Diisocyanate	N120	45.22%

TSCA Section 8(b) Inventory

All reportable chemical substances are listed on the TSCA Inventory. We rely on certifications of compliance from our suppliers for chemical substances not manufactured by us.

15.2 Canadian Regulations

Workplace Hazardous Materials Information System (WHMIS)

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation (CPR) and the MSDS contains all the information required by the CPR.

Class B3
Class D1A
Class D1B
Class D2A
Class D2B

Canadian Environmental Protection Act (CEPA)

All reportable chemical substances are listed on the Domestic Substances List (DSL) or otherwise comply with CEPA new substance notification requirements.

National Pollutant Release Inventory (NPRI)

This product contains the following chemical(s) subject to the reporting requirements of the Canadian Environmental Protection Act (CEPA) subsection 16(1), National Pollutant Release Inventory.

Naphthalene	91-20-3	1.76%
Methylenebis(phenylisocyanate)	101-68-8	27.28%
Polymeric Diphenylmethane Diisocyanate	9016-87-9	45.22%

16. Other Information

User's Responsibility

The OSHA Hazard Communication Standard 29CFR 1910.1200 and the Workplace Hazardous Materials Information System (WHMIS) require that the information contained on these sheets be made available to your workers. Educate and train your workers regarding OSHA and WHMIS precautions. Instruct your workers to handle this product properly. Consult with appropriate experts to guard against hazards associated with use of this product and its ingredients.

Disclaimer

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE, except that the product shall conform to contracted specifications, and that the product does not infringe any valid United States or Canadian patent. No claim of any kind shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.



MATERIAL SAFETY DATA SHEET

FOR INDUSTRIAL USE ONLY

DESCRIPTION: Techniset® 6636 UNB Pt2

1. Chemical Product and Company Identification

DESCRIPTION: **Techniset® 6636 UNB Pt2**
PRODUCT CODE: 338915
PRODUCT TYPE: Liquid Isocyanate Resin
APPLICATION: Urethane No Bake System
Sold Under U.S. Patent Number - 6,136,888

Manufacturer/Supplier Information

MSDS prepared by:
HA International, LLC
630 Oakmont Lane
Westmont, IL
60559

For Emergency Medical Assistance
Call Health & Safety Information Services
1-866-303-6949

For additional health and safety or regulatory information, call (630)575-5722, or (630)575-5705.

2. Hazards Identification

2.1 Emergency Overview

Appearance	Dark brown to black liquid
Odor	Hydrocarbon solvent

WARNING!

Toxic gases/fumes may be given off during burning or thermal decomposition. Closed container may forcibly rupture under extreme heat or when contents have been contaminated with water. Use cold water spray to cool fire-exposed containers to minimize the risk of rupture.

May become unstable at high temperatures or may react with water.

Hazardous polymerization may occur.

Harmful if inhaled. If material is heated, sprayed or otherwise dispersed, may cause irritation of nose, throat and lungs.

May cause allergic respiratory reaction.

Causes eye irritation.

Causes skin irritation.

May cause allergic skin reaction.

NORTH AMERICAN EMERGENCY RESPONSE GUIDE, 2000, NO: 171

HMIS Rating

HEALTH = 3 (serious)
FLAMMABILITY = 1 (slight)

REACTIVITY = 1 (slight)
 CHRONIC = *

HMIS® ratings involve data interpretations that may vary from company to company. They are intended only for the rapid, general identification of the magnitude of the specific hazard. To deal adequately with the safe handling of this material, all the information contained in this MSDS must be considered.

2.2 Potential Health Effects

Immediate Hazards

INGESTION:	Not expected to be harmful under normal conditions of use. If accidentally swallowed, burns or irritation to mucous membranes, esophagus or GI tract can result.
INHALATION:	Harmful if inhaled. If material is heated, sprayed or otherwise dispersed, may cause irritation of nose, throat and lungs. Exposures to concentrations below the exposure guidelines may cause allergic respiratory reactions in individuals already sensitized. Symptoms may include coughing, difficult breathing and a feeling of tightness in the chest. Effects may be delayed.
SKIN:	Skin contact may result in allergic skin reactions or respiratory sensitization. However, it is not expected to result in absorption of amounts sufficient to cause other adverse effects. Isocyanates react with skin protein and moisture and can cause irritation. Cured material is difficult to remove.
EYES:	Causes irritation.

Delayed Hazards

101-68-8 Diphenylmethane 4,4'-Diisocyanate (MDI)

Lung tumors have been observed in laboratory animals exposed to aerosol droplets of diphenylmethane 4,4'-diisocyanate (MDI)/polymeric MDI (6 mg/m³) for their lifetime. Tumors occurred concurrently with respiratory irritation and lung injury. This material has not been listed by NTP, classified by IARC, nor regulated by OSHA as a carcinogen.

Repeated exposure or a single large exposure may cause isocyanate sensitization (chemical asthma). Once sensitized, individuals may react to a later exposure at levels well below the applicable exposure limits. These symptoms, which can include chest tightness, wheezing, cough, shortness of breath or asthmatic attack, could be immediate or delayed up to several hours after exposure. There are reports that once sensitized, symptoms may occur upon exposure to dust, cold air or other irritants. Sensitization can either be temporary or permanent.

Chronic overexposure to isocyanates has also been reported to cause lung damage (including fibrosis, decrease in lung function) which may be permanent. Preexisting asthma and other respiratory disorders (bronchitis, emphysema, hyperreactivity) may be aggravated by exposure.

9016-87-9 Polymeric Diphenylmethane Diisocyanate

See hazards listed above for MDI (CAS# 101-68-8).

-- See Footnote at end of section

26447-40-5 Isocyanic Acid, Methylenediphenylene Ester

See hazards listed above for MDI (CAS# 101-68-8).

-- See Footnote at end of section

Footnote: As of the date of issuance of this document, this material has not been listed by NTP, classified by IARC nor regulated by OSHA as a carcinogen.

3. Composition, Information on Ingredients

The ingredients listed below have been associated with one or more immediate and/or delayed(*) health hazards. Risk of damage and effects depends upon duration and level of exposure. BEFORE USING, HANDLING, OR EXPOSURE TO THESE INGREDIENTS, READ AND UNDERSTAND THE MSDS.

		% by weight
9016-87-9	*Polymeric Diphenylmethane Diisocyanate	30.0 - 50.0
101-68-8	*Diphenylmethane 4,4'-Diisocyanate (MDI)	30.0 - 50.0
26447-40-5	*Isocyanic Acid, Methylenediphenylene Ester	5.0 - 10.0
108-32-7	Propylene Carbonate	1.0 - 5.0

Any applicable Canadian trade secret numbers will be listed in Section 15.2.

4. First Aid Measures

INGESTION:	If accidentally swallowed, dilute by drinking large quantities of water. If the individual is drowsy or unconscious, do not give anything by mouth. Immediately contact poison control center or hospital emergency room for advice on whether to induce vomiting or for any other additional treatment directions.
INHALATION:	If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Asthmatic-type symptoms may develop and may be immediate or delayed up to several hours. Treatment is essentially symptomatic. Call a physician. Any individual having a dermal or pulmonary sensitization reaction to this material must be removed from any further exposure to any isocyanate.
SKIN:	Immediately wash with soap and plenty of water for at least 15 minutes while removing contaminated clothing. Call a physician if symptoms occur. Wash clothing before reuse.
EYES:	Immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held apart during irrigation to ensure water contact with entire surface of eyes and lids. Call a physician.

5. Fire Fighting Measures

Suitable Extinguishing Media: In case of fire, use dry chemical, foam or CO₂; use water spray for large fires. Reacts with water to produce CO₂. Water contamination can cause rupture of closed containers. Wear full emergency protective equipment including NIOSH approved pressure demand self-contained breathing apparatus. Isocyanate vapors and other irritating, highly toxic gases may be generated by thermal decomposition or combustion. Cool fire-exposed containers with cold-water spray to minimize risk of rupture.

Will burn.

6. Accidental Release Measures

Evacuate area of all persons not wearing proper protective equipment. If indoors, ventilate area. If product is on the ground, dike area to prevent entry into water systems and soil. Wear full protective equipment including respiratory equipment during clean-up. If temporary control of isocyanate vapor is required, a blanket of protein foam (available at most fire departments) may be spread. Contain and/or absorb spill with inert material (e.g. sand, vermiculite), place in a suitable unsealed container, transport to well-ventilated area (outside) and treat with neutralizing solution: mixture of water (80%) with non-ionic surfactant Tergitol TMN-10 (20%), or; water (90%), concentrated ammonia (3-8%) and liquid detergent (2%). Add about 10 parts of neutralizer per one part of isocyanate, with mixing. Allow to stand uncovered for 48 hours to let CO₂ escape.

7. Handling and Storage

7.1 Handling

Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure and removal of the material from eyes, skin and clothing. Wash thoroughly after handling. Always use appropriate Personal Protective Equipment (PPE).

INHALATION: Do not breathe aerosols or vapors. Warning properties (irritation of the eyes, nose and throat or odor) are not adequate to prevent chronic overexposure from inhalation. This material can produce asthmatic sensitization upon either single inhalation exposure to a relatively high concentration or upon repeated inhalation exposures to lower concentrations.

SKIN: Avoid contact with skin and clothing.

EYES: Avoid contact with eyes.

Do not allow containers to be heated above recommended storage temperatures because they can be pressurized and possibly rupture. Exposure to vapors of heated isocyanate can be dangerous. Employee education and training in the safe use and handling of isocyanates is required.

7.2 Storage

Never use air pressure to empty containers.
Do not use air to unload bulk trucks. Unload using pumps or an inert gas, such as nitrogen.
Use with adequate ventilation.
Will react with water. Keep tightly closed and dry.
Do not store near strong oxidizing chemicals.

8. Exposure Controls/Personal Protection

8.1 Exposure Guidelines

9016-87-9 Polymeric Diphenylmethane Diisocyanate	
ACGIH TLV	None established
OSHA PEL	None established
101-68-8 Diphenylmethane 4,4'-Diisocyanate (MDI)	
ACGIH TLV	8-hr TWA 0.005 ppm
OSHA PEL	Ceiling 0.02 ppm
26447-40-5 Isocyanic Acid, Methylenediphenylene Ester	

ACGIH TLV	None
	Established
OSHA PEL	None
	Established
108-32-7	Propylene Carbonate
ACGIH TLV	None established
OSHA PEL	None established

8.2 Exposure Controls

ENGINEERING CONTROLS: The following exposure control techniques may be used to effectively minimize employee exposure: local exhaust ventilation, enclosed system design, process isolation and remote control in combination with appropriate use of personal protective equipment and prudent work practices. These techniques may not necessarily address all issues pertaining to your operations. We, therefore, recommend that you consult with experts of your choice to determine whether or not your programs are adequate.

If airborne contaminants are generated, sufficient ventilation in volume and air flow patterns should be provided to keep air contaminant concentration levels below acceptable criteria.

8.3 Personal Protection

Wear synthetic apron and boots if contact is likely. Where air contaminants can exceed acceptable criteria, use NIOSH (42 CFR Part 84) air supplied approved respiratory protection equipment. Respirators should be selected based on the form and concentration of contaminants in air in accordance with OSHA laws and regulations or other applicable standards or guidelines, including ANSI standards regarding respiratory protection. OSHA permits other NIOSH respirators (negative pressure type) under specified conditions. Use goggles and face shield if contact is likely. Wear permeation resistant gloves (butyl rubber, nitrile rubber, neoprene) as required to prevent skin contact. Cover as much of the exposed skin area as possible with appropriate clothing.

MEDICAL SURVEILLANCE: Medical supervision of all employees who handle or come in contact with isocyanates is recommended. These should include preemployment and periodic medical examinations with pulmonary respiratory allergies such as hay fever, eczema, history of prior isocyanate sensitization, or lack of smell (anosmia) are possible reasons for medical exclusion from isocyanate areas. Once a person is accurately diagnosed as sensitized to an isocyanate, no further exposure can be permitted.

9. Physical and Chemical Properties

Appearance	Dark brown to black liquid
Odor	Hydrocarbon solvent
Odor threshold	Not available
pH	Not applicable
Boiling point, 760 mm Hg	Not available
Flash point	Greater than 100 °C (212 °F) Tag Closed
	Cup ASTM D 56
Evaporation rate	Not available
Lower explosion limit	Not available
Upper explosion limit	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.162

Solubility in water	Insoluble
Octanol/water partition coefficient	Not available
Autoignition temperature	Not available
Viscosity	50 cPs Brookfield

10. Stability and Reactivity

Chemical Stability

Normally stable. Contact with moisture or other materials that react with isocyanates, or temperatures above 350°F (177°C) may cause polymerization. Product may form carbon dioxide which will cause a build-up of pressure in closed containers causing a possible hazardous rupture.

Conditions to avoid

High heat and moisture.

Incompatible Materials

Water, alcohols, amines, bases and direct UV.
Strong oxidizers, reducing agents, acids and alkaline materials.

Hazardous Decomposition Products

CO, CO₂, aldehydes (including formaldehyde), phenols, hydrogen cyanide, ammonia, particulate matter and other organic compounds including benzo[a]pyrene.

Possibility of Hazardous Reactions

Hazardous polymerization may occur.

Other Hazards

During core/mold making, vapors of hydrocarbons and 4,4'-diphenylmethane diisocyanate may be released.

11. Toxicological Information

See Section 3 Hazards Identification information.

9016-87-9 Polymeric Diphenylmethane Diisocyanate

LC50: rat=0.490 mg/l/4 h (vapor)

LD50: Oral-rat=Greater than 10,000 mg/kg (Sax); Skin-rabbit=Greater than 9,400 mg/kg (Sax)

101-68-8 Diphenylmethane 4,4'-Diisocyanate (MDI)

LC50: rat=0.178 mg/l (RTECS)

LD50: Oral-muskrat= 2,200 mg/kg (RTECS); Skin-rabbit=Greater than 10,000 mg/kg (vendor)

26447-40-5 Isocyanic Acid, Methylenediphenylene Ester

LC50: Not available

LD50: Not available

108-32-7 Propylene Carbonate

LC50: Not available

LD50: Oral-mice= 20,700 mg/kg (Sax) LD50: Oral-rat=Greater than 5,000 mg/kg (vendor); Skin-rabbit=Greater than 2,000 mg/kg (vendor)

12. Ecological Information

Mono- and poly-diphenylmethane diisocyanates react readily with water to form insoluble polyureas. Therefore, no ecotoxicity data for the isocyanates is available. The monomer degrades photochemically in air with an estimated half-life of 32 hours. Leaching from soil is not environmentally important. Bioconcentration in carp does not occur over an eight week period.

13. Disposal Considerations

Dispose of according to local, state/provincial, and federal requirements. Incineration is the preferred method. Empty container: Empty containers retain product residue. Observe all precautions for product. DO NOT heat or cut empty container with electric or gas torch because highly toxic vapors and gases are formed. Do not reuse without thorough commercial cleaning and reconditioning. If container is to be disposed, ensure all product residues are removed prior to disposal.

14. Transport Information

14.1 U.S. Department of Transportation (DOT)

The data provided in this section is for information only and may not be specific to your package size or mode of transport. You will need to apply the appropriate regulations to properly classify your shipment for transportation.

Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Diphenylmethane 4,4'-Diisocyanate (MDI),)
UN/NA number	3082
Class	9
Packing group	III
Label	9
RQ Ingredients	Diphenylmethane 4,4'-Diisocyanate (MDI)

14.2 Canadian Transportation of Dangerous Goods (TDG)

Regulation:	Non regulated
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14.3 Other Regulations

• <i>ADR/RID</i>	
Regulation:	Non regulated
• <i>IMO/IMDG</i>	
Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.
UN Number	3082
Class	Class 9
Packing group	III
Label	9
• <i>IATA (Passenger)</i>	
Regulation:	Non regulated

15. Regulatory Information (Selected Regulations)

15.1 U.S. Federal Regulations

OSHA Hazards Communication Standard 29CFR1910.1200

This material is a "health hazard" and/or a "physical hazard" as determined when reviewed according to the requirements of the Occupational Safety and Health Administration 29 CFR Part 1910.1200 "Hazard Communication" Standard.

SARA Title III: Section 311/312

Reactivity hazard
Immediate health hazard
Delayed health hazard

SARA Title III: Section 313 and 40 CFR Part 372

This product contains the following toxic chemical(s) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986, and Subpart C-Supplier Notification Requirement of 40 CFR Part 372.

Methylenebis(4-phenylisocyanate) (MDI)	N120	33.75%
Polymeric Diphenylmethane Diisocyanate	N120	41.16%

TSCA Section 8(b) Inventory

All reportable chemical substances are listed on the TSCA Inventory. We rely on certifications of compliance from our suppliers for chemical substances not manufactured by us.

15.2 Canadian Regulations

Workplace Hazardous Materials Information System (WHMIS)

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation (CPR) and the MSDS contains all the information required by the CPR.

Class D1A
Class D2A
Class D2B

Canadian Environmental Protection Act (CEPA)

All reportable chemical substances are listed on the Domestic Substances List (DSL) or otherwise comply with CEPA new substance notification requirements.

National Pollutant Release Inventory (NPRI)

This product contains the following chemical(s) subject to the reporting requirements of the Canadian Environmental Protection Act (CEPA) subsection 16(1), National Pollutant Release Inventory.

Methylenebis(phenylisocyanate)	101-68-8	33.75%
Polymeric Diphenylmethane Diisocyanate	9016-87-9	41.16%

16. Other Information

User's Responsibility

The OSHA Hazard Communication Standard 29CFR 1910.1200 and the Workplace Hazardous Materials Information System (WHMIS) require that the information contained on these sheets be made available to your workers. Educate and train your workers regarding OSHA and WHMIS precautions. Instruct your workers to handle this product properly. Consult with appropriate experts to guard against hazards associated with use of this product and its ingredients.

Disclaimer

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE, except that the product shall conform to contracted specifications, and that the product does not infringe any valid United States or Canadian patent. No claim of any kind shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

Material Safety Data Sheet

Techniset® 6636T UNB Pt2

1. Product and company identification

Product name Techniset® 6636T UNB Pt2

MSDS Number 300000009237

Product Type Isocyanate-based Urethane Resin Coreactant

Product use Foundry Core and Mold/Mould Applications - Part 2

Manufacturer, Importer, Supplier HA International, LLC
630 Oakmont Lane
Westmont, IL
60559

Print date 18-NOV-2008

Telephone **For Emergency Medical Assistance**
Call Health & Safety Information Services, 1-866-303-6949

For Emergency Transportation Information

CHEMTREC US Domestic (800) 424-9300
CHEMTREC International (703) 527-3887
CANUTEC CA Domestic (613) 996-6666

For additional health and safety or regulatory information, call (630)575-5722, or (630)575-5705.

2. Hazards identification

Form Liquid

Odor Slight pine

OSHA/HCS status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview WARNING !
TOXIC IF INHALED. HARMFUL IN CONTACT WITH SKIN OR IF SWALLOWED. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY CAUSE ALLERGIC RESPIRATORY AND SKIN REACTION.

Potential acute health effects

Inhalation Irritating to respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure. Toxic if inhaled. Repeated exposure or a single large exposure may cause isocyanate sensitization (chemical asthma). Once sensitized, individuals may react to a later exposure at levels well below the applicable exposure limits. These symptoms could be immediate or delayed up to several hours after exposure. There are reports that once sensitized, symptoms may occur upon exposure to dust, cold air or other irritants. Sensitization can either be temporary or permanent.

Ingestion Harmful if swallowed.

Skin Harmful in contact with skin. Irritating to skin. May cause sensitization by skin contact. Skin contact may trigger respiratory sensitization and symptoms of allergic response including airway restriction, inflammation of airway tissues, and breathing difficulty. Isocyanates react with skin protein and moisture and can cause irritation and skin staining. Cured material is difficult to remove.

Eyes Irritating to eyes.

Potential chronic health effects

Chronic effects Contains material that can cause target organ damage. Can cause lung inflammation. Chronic overexposure to isocyanates has also been reported to cause lung damage (including fibrosis, decrease in lung function) which may be permanent. Preexisting asthma and other respiratory disorders (bronchitis, emphysema, hyperreactivity) may be aggravated by exposure.

Carcinogenicity Contains material which may cause cancer, based on animal data. Risk of cancer depends on duration and level of exposure.

Mutagenicity No known significant effects or critical hazards.

Teratogenicity No known significant effects or critical hazards.

Developmental effects No known significant effects or critical hazards.

Fertility effects No known significant effects or critical hazards.

Target organs Contains material which causes damage to the following organs: kidneys, lungs, central nervous system (CNS) Review Section 2 and 11 for any additional assessments.

Over-exposure signs/symptoms

Inhalation Adverse symptoms may include the following: respiratory tract irritation, coughing, wheezing and breathing difficulties, asthma, chest tightness or wheezing irritation, breathing difficulty or shortness of breath asthmatic attack,

Ingestion Adverse symptoms may include the following: irritation,

Skin Adverse symptoms may include the following: irritation, redness,

Eyes Adverse symptoms may include the following: pain or irritation, watering, redness,

Medical conditions aggravated by over-exposure Pre-existing respiratory, skin and digestive disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See section 11 for more detailed information on health effects and symptoms.

3. Composition and information on ingredients

<u>Ingredient name</u>	<u>CAS number</u>	<u>%</u>
Polymeric Diphenylmethane Diisocyanate	9016-87-9	30.0 - 50.0
Diphenylmethane 4,4'-Diisocyanate (MDI)	101-68-8	30.0 - 50.0
Tetraethyl Orthosilicate	78-10-4	10.0 - 30.0
Isocyanic Acid, Methylenediphenylene Ester	26447-40-5	5.0 - 10.0

*** Any applicable Canadian trade secret numbers will be listed in Section 15.*

4. First aid measures

Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention.
Skin contact	Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing or wear gloves. Continue to rinse for at least 10 minutes. Note: An MDI study has demonstrated that a polyglycol-based skin cleanser or corn oil may be more effective than soap and water. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
Inhalation	Move exposed person to fresh air. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. Keep person warm and at rest. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. Asthmatic-type symptoms may develop and may be immediate or delayed up to several hours. Treatment is essentially symptomatic. Any individual having a dermal or pulmonary sensitization reaction to this material must be removed from any further exposure to any isocyanate. The potential for inhalation of hazardous isocyanate vapors is present when this product is heated to temperatures above 130°F (54°C), or when the product is sprayed. Get medical attention immediately. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours. In the event of any complaints or symptoms, avoid further exposure.
Ingestion	Get medical attention immediately. Wash out mouth with water. Remove dentures if any. Move exposed person to fresh air. Keep person warm and at rest. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Protection of first aid personnel	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing or wear gloves.
Notes to physician	In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

See section 11 for more detailed information on health effects and symptoms.

5. Fire-fighting measures

Flammability of the product	In a fire or if heated, a pressure increase will occur and the container may burst.
<u>Extinguishing media</u>	
Suitable	Use dry chemical, CO ₂ , water spray (fog) or foam.
Not suitable	sharp water jet.
Special exposure hazards	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Hazardous combustion products	Decomposition products may include the following materials: carbon oxides, nitrogen oxides, metal oxide/oxides, hydrocarbon, hydrogen cyanide, irritating and toxic fumes and gasses .
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.
Special Remarks on Explosion Hazards	Reacts with water to produce CO ₂ . Water contamination can cause rupture of closed containers. Cool fire-exposed containers with cold-water spray to minimize risk of rupture.

6. Accidental release measures

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Large spill	Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13) or treat with neutralizing solution: mixture of water (80%) with non-ionic surfactant Tergitol TMN-10 (20%), or water (90%), concentrated ammonia (3-8%) and liquid detergent (2%). Add about 10 parts of neutralizer per one part of isocyanate, with mixing. Allow containers to stand uncovered for 48 hrs to let CO ₂ escape. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal. Notify applicable government authorities if release is reportable.

Small spill

Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7. Handling and storage

Warning properties (irritation of the eyes, nose and throat or odor) are not adequate to prevent overexposure from inhalation. This material can produce asthmatic sensitization upon either single inhalation exposure to a relatively high concentration or upon repeated inhalation exposures to lower concentrations.

Handling

Exposure to vapors of heated isocyanate can be dangerous. Employee education and training in the safe use and handling of isocyanates is required. Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitisation problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage

Store in an area designated for storage of flammable liquids (See NFPA 30 and OSHA 29 CFR 1910.106). Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep containers away from moisture. Keep container tightly closed and sealed until ready for use. Store between 18°C (64°F) and 30°C (86°F). If container is exposed to high heat, it can be pressurized and possibly rupture. Due to reaction with water producing CO₂ gas, hazardous pressure may develop if contaminated containers are re-sealed. Do not reseal contaminated containers. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8. Exposure controls/personal protection

Ingredient name**Occupational exposure limits**

Diphenylmethane 4,4'-Diisocyanate (MDI)

ACGIH TLV 8-hr TWA

0.05 mg/m³ 0.01 ppm

OSHA PEL Ceiling

0.2 mg/m³ 0.02 ppm

Tetraethyl Orthosilicate

ACGIH TLV 8-hr TWA

85 mg/m³ 10 ppm

OSHA PEL 8-hr TWA

850 mg/m³ 100 ppm

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures

Medical supervision of all employees who handle or come in contact with isocyanates is recommended including pre-employment and periodic medical examinations. Persons with respiratory problems including asthmatic-type conditions, chronic bronchitis, other chronic respiratory diseases or recurrent skin eczema or skin allergies should be evaluated to determine their suitability for working with this product. Possible reasons for medical exclusion from isocyanate handling areas include pulmonary respiratory allergies such as hay fever, eczema, history of prior isocyanate sensitization, or lack of smell (anosmia). Once a person is accurately diagnosed as sensitized to an isocyanate, no further exposure should be permitted.

If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures

Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Respiratory

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands

Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Recommended:

- neoprene
- nitrile rubber
- butyl rubber

Thin disposable latex gloves should not be used for protection from hazardous chemicals.

Eyes

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts.

Skin

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Environmental exposure controls	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.
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9. Physical and chemical properties

Form	Liquid
Flash point	Greater than 100 °C(212 °F) Tag Closed Cup ASTM D 56
Auto-ignition temperature	Not available
Flammable limits	
Lower:	Not available
Upper:	Not available
Color	Dark brown to black
Odor	Slight pine
pH	Not applicable
Boiling point	Not available
Relative density	1.13 - 1.16
Vapor pressure	Not available
Viscosity	Dynamic - 40 cPs Brookfield
Solubility	Insoluble
Partition coefficient: n-octanol/water	Not available
Evaporation rate	Not available
Vapor density	Not available

10. Stability and reactivity

Stability	Hazardous polymerization may occur under certain conditions of storage or use.
Conditions to avoid	Avoid high temperatures and moisture. Reacts with water (moisture) to produce CO ₂ gas. Exothermic reaction with materials containing active hydrogen groups such as water, amines, alcohols, acids, and bases. The reaction becomes progressively more vigorous and can be violent at higher temperatures if the miscibility of the reaction partners is good or is supported by stirring, or in the presence of solvents. The reaction with water produces an insoluble solid polyurea compound and carbon dioxide gas.
Materials to avoid	Reactive or incompatible with the following materials: water, alcohols, amines, alkalis, copper alloys, acids,
Other hazards	May react dangerously if inadvertently mixed with other components of this resin system resulting in elevated temperatures, release of flammable and/or toxic vapors, foaming, solidification, and vessel rupture or other equipment damage. Prevent inadvertent mixing of Part 1 and Part 2 resin system components through effective unloading system and process design, labeling, procedures, employee training, and verification audit programs.
Hazardous decomposition products	Hazardous emissions are normally generated when cores or molds are exposed to molten metal during pouring, cooling and shakeout operations due to the partial thermal decomposition of the binder system and other components of the mold package. These emissions can reach hazardous levels and may potentially include but are not limited to carbon monoxide, carbon dioxide, benzene, aldehydes including formaldehyde, phenol, hydrogen cyanide,

ammonia, and a wide variety of organic compounds including benzo(a)pyrene. Oxygen may be deficient in pouring, cooling and shakeout areas. Hazardous particulate matter is also normally generated at hazardous concentrations during pouring, cooling and shakeout operations including, but not limited to smoke, soot, polycyclic organic compounds, and crystalline silica.

11. Toxicological information

Acute toxicity

Ingredient name

Polymeric Diphenylmethane Diisocyanate			
LD50	Oral	Rat	49,000 mg/kg
LC50	Inhalation	Rat	0.49 mg/l/4 h
LD50	Dermal	Rabbit	> 9,400 mg/kg
Diphenylmethane 4,4'-Diisocyanate (MDI)			
LD50	Oral	Rat	9,200 mg/kg
LD50	Oral	Mouse	2,200 mg/kg
LC50	Inhalation	Rat	0.178 mg/l/
LD50	Dermal	Rabbit	> 10,000 mg/kg
Tetraethyl Orthosilicate			
LD50	Oral	Rat	6,270 mg/kg
LD50	Dermal	Rat	5,875 mg/kg

Other Toxicological Information

Carcinogenicity

Conclusion/Summary

Isocyanate -MDI: Lung tumors have been observed in laboratory animals exposed to aerosol droplets of diphenylmethane 4,4'-diisocyanate (MDI)/polymeric MDI (6 mg/m³) for their lifetime. Tumors occurred concurrently with respiratory irritation and lung injury.

Classification

Ingredient name

<u>Polymeric Diphenylmethane Diisocyanate</u>		
ACGIH	Not classified	
IARC	Not classifiable as to its carcinogenicity to humans.	
NTP	Not listed	
OSHA	Not regulated	
Diphenylmethane 4,4'-Diisocyanate (MDI)		
ACGIH	Not classified	
IARC	Not classifiable as to its carcinogenicity to humans.	
NTP	Not listed	
OSHA	Not regulated	
Tetraethyl Orthosilicate		
ACGIH	Not classified	
IARC	Not classified	
NTP	Not listed	
OSHA	Not regulated	
Isocyanic Acid, Methylenediphenylene Ester		
ACGIH	Not classified	
IARC	Not classified	
NTP	Not listed	
OSHA	Not regulated	

12. Ecological information

Environmental effects

Mono- and poly-diphenylmethane diisocyanates react readily with water to form insoluble polyureas. Therefore, no ecotoxicity data for the isocyanates is available. The monomer

degrades photochemically in air with an estimated half-life of 32 hours. Leaching from soil is not environmentally important. Bioconcentration in carp does not occur over an eight-week period.

Other adverse effects

No known significant effects or critical hazards.

13. Disposal considerations

Waste disposal

The generation of waste should be avoided or minimized wherever possible. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. DO NOT heat or cut empty container with electric or gas torch because highly toxic vapors and gases are formed. Do not reuse without thorough commercial cleaning and reconditioning. If container is to be disposed, ensure all product residues are removed prior to disposal. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

14. Transportation

The data provided in this section is for information only and may not be specific to your package size or mode of transport. You will need to apply the appropriate regulations to properly classify your shipment for transportation.

International transport regulations

Regulatory information	UN number	Proper shipping name	Classes/*PG	Reportable Quantity (RQ)
CFR	3082	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Diphenylmethane 4,4'-Diisocyanate (MDI))	Class 9 III	Diphenylmethane 4,4'-Diisocyanate (MDI)
TDG		Non-regulated		
IMO/IMDG	3082	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. contains (Diphenylmethane 4,4'-Diisocyanate (MDI))	Class 9 III	Diphenylmethane 4,4'-Diisocyanate (MDI)

*PG : Packing group

15. Regulatory information

US regulations

HCS Classification Toxic material, Irritating material, Sensitizing material, Carcinogen, Target organ effects

U.S. Federal regulations

SARA 311/312 Classification Immediate (acute) health hazard, Delayed (chronic) health hazard, reactive

SARA 313 - Supplier Notification

This product contains the following toxic chemical(s) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986, and Subpart C-Supplier Notification Requirement of 40 CFR Part 372.

Polymeric Diphenylmethane Diisocyanate - 9016-87-9 (41.88%), Diphenylmethane 4,4'-Diisocyanate (MDI) - 101-68-8 (30.23%),

SARA 302 Extremely Hazardous Substances None required.

State regulations

Massachusetts RTK Substances The following components are listed:
Diphenylmethane 4,4'-Diisocyanate (MDI), Tetraethyl Orthosilicate,

New Jersey RTK Hazardous Substances The following components are listed:
Polymeric Diphenylmethane Diisocyanate, Diphenylmethane 4,4'-Diisocyanate (MDI), Tetraethyl Orthosilicate,

Pennsylvania RTK Hazardous Substances The following components are listed:
Diphenylmethane 4,4'-Diisocyanate (MDI), Tetraethyl Orthosilicate,

California Prop. 65: None required.

Canada

WHMIS (Canada)

Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Canadian lists

Canadian NPRI: The following components are listed: Polymeric Diphenylmethane Diisocyanate, Diphenylmethane 4,4'-Diisocyanate (MDI),

International regulations

Chemical inventories

Europe inventory Not determined.
Australia inventory (AICS) All components are listed or exempted.
China inventory (IECSC) All components are listed or exempted.
Korea inventory (KECI) All components are listed or exempted.
Philippines inventory (PICCS) Not determined.
Japan inventory (ENCS) Not determined.
United States inventory (TSCA 8b) All components are listed or exempted.
Canada inventory All components are listed or exempted.

16. Other information

**Hazardous Material
Information System III
(U.S.A.)**

Health : 3
Flammability: 1
Physical hazards : 0
Chronic : *

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

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